FIG. 14A depicts the variation of the potentials on deflection plates 58 through 67 when the multideflector is used in focusing mode. FIG. 14B depicts the corresponding variation in the electric field strength with position. So in the case of FIG. 14, ion path 68 shows a smaller angle of deflection than ion path 76 and thus the ion beam is focused. Similar focusing and defocusing effects can be obtained by varying the lengths of the deflection plates or the distances between them in accordance with equation 5.

While the foregoing embodiments of the invention have been set forth in considerable detail for the purposes of making a complete disclosure of the invention, it will be apparent to those of skill in the art that numerous changes may be made in such details without departing from the spirit and the principles of the invention.

We claim:

1. An improved time of flight mass spectrometer comprising:

a deflector for deflecting an ion from an ion path consisting of more than two plates arranged across said ion path in such a way that, during a given passage through said deflector, said ion must pass between two and only two adjacent plates; and

a detector for detecting said ion;

wherein each of said plates is energized to a potential.

2. An improved time of flight mass spectrometer according to claim 1 wherein said deflector is formed by a series of conductive plates.

3. An improved time of flight mass spectrometer according to claim 2 wherein at least one of said conductive plates is metallic.

4. An improved time of flight mass spectrometer according to claim 1 wherein said deflector deflects substantially all ions away from said ion path.

5. An improved time of flight mass spectrometer according to claim 1 wherein said detector is responsive to the number of ions not deflected away from said ion path.

6. An improved time of flight mass spectrometer according to claim 1 wherein said ions are deflected away from said ion path along a plurality of directions.

7. An improved time of flight mass spectrometer according to claim 6 wherein said mass deflector is formed by a series of conductive plates.

8. An improved time of flight mass spectrometer according to claim 1 wherein said deflector is used as a mass selector.

9. An improved time of flight mass spectrometer according to claim 1 wherein at least of said plates is energized to a positive potential and another of said plates is energized to a negative potential.

10. A multideflector for analyzing ions in a time of flight mass spectrometer comprising:

an ion source;

an ion detector;

a flight tube for transporting ions formed within said ion source; and

a gate disposed along said flight tube;

wherein said ion source produces ions capable of travel along said flight tube, and wherein said detector detects the presence of said ions; and

wherein said gate is formed by a series of metal plates arranged across said flight tube in such a way that, during a given passage through said multideflector, said ions must pass between two and only two adjacent

plates, said plates being aligned to deflect substantially all ions away from the direction of ion propagation along said flight tube.

11. A multideflector according to claim **10** wherein at least one of said plates is conductive.

12. A multideflector according to claim **11** wherein at least one of said conductive plates is metallic.

13. A multideflector according to claim **10** wherein said gate deflects said ions into a plurality of directions.

14. A multideflector according to claim **10** wherein said ion source includes a laser.

15. A multideflector according to claim **10** wherein a data acquisition system is used to measure the time of flight of ions from said ion source to said detector.

16. A multideflector according to claim **15** wherein a multiplicity of detectors are used.

17. A multideflector according to claim **10** wherein a reflector is used to alter the path of ions away from said direction of propagation.

18. A multideflector according to claim **10** wherein a gate is used to select ions based on mass.

19. A mass selector for use in a time of flight instrument comprising:

a flight tube;

a gate; and

an ion source;

wherein said ion source produces ions that travel through said flight tube, and wherein said gate impedes the travel of said ions by deflecting said ions into at least two directions.

20. A mass selector according to claim 19 wherein said gate is formed of a plurality of metal plates, of which at least one of said metallic plates is energized.

21. A mass selector according to claim 19 which includes a computer controller.

22. A mass selector according to claim 21 wherein said computer controller includes means to vary voltages applied to said gate.

* * * * *

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Add C4

23. A improved time of flight mass spectrometer comprising:

a multideflector for deflecting ions from an ion path consisting of more than two bipolar deflection plates each comprising a pair of metal plates separated from one another by an insulator, said bipolar deflection plates being arranged across said ion path in such a way that, during a given passage through said multideflector, each of said ions must pass between two and only two adjacent bipolar deflection plates; and

a detector for detecting said ions;

wherein each of said metal plates is energized to a potential and the potentials of the metal plates of each pair have opposite polarities.

24. An improved time of flight mass spectrometer according to claim 23 wherein the total thickness of each bipolar deflector plate is in order of 0.1 mm.

25. An improved time of flight mass spectrometer according to claim 23 wherein the insulator consists of polyamide layer.

26. An improved time of flight mass spectrometer according to claim 24 wherein the insulator consists of polyamide layer.

27. An improved time of flight mass spectrometer according to claim 23 wherein the bipolar deflection plates are curved.

28. An improved time of flight mass spectrometer according to claim 24 wherein the bipolar deflection plates are curved.

29. An improved time of flight mass spectrometer according to claim 25 wherein the bipolar deflection plates are curved.

30. An improved time of flight mass spectrometer according to claim 26 wherein the bipolar deflection plates are curved.

31. An improved time of flight mass spectrometer according to claim 23 wherein the bipolar deflection plates are placed adjacent and parallel to one another such that each metal plate of every bipolar deflection plate is facing the metal plate of the adjacent bipolar deflection plate which has the opposite polarity.

32. An improved time of flight mass spectrometer according to claim 31 wherein the distance between adjacent bipolar deflection plates is a constant.

33. An improved time of flight mass spectrometer according to claim 32 wherein the bipolar defection plates are curved.

34. A multideflector according to claim 31 wherein the distance between adjacent bipolar deflection plates varies as a function of position within the multideflector.

35. A multideflector according to claim 34 wherein the bipolar deflection plates are curved.

36. A multideflector according to claim 23 wherein the potentials on the conducting electrodes is held constant.

37. A multideflector according to claim 23 wherein the potentials on the conducting electrodes is varied as a function of time.

38. A multideflector according to claim 32 wherein the potentials on the conducting electrodes is held constant.

39. A multideflector according to claim 32 wherein the potentials on the conducting electrodes is varied as a function of time.

40. An improved time of flight mass spectrometer according to claim 1 wherein said deflector deflects substantially all ions from one ion path to a second ion path.

41. A multideflector consisting of more that two bipolar deflection plates each of which consists of a pair of electrically conducting electrodes separated from one another by an insulator and wherein each of said conducting electrodes is energized to a potential and the potentials on the electrodes of each bipolar deflection plate are of opposite polarities.

42. An improved time of flight mass spectrometer according to claim 41 wherein the total thickness of each bipolar deflector plate is in order of 0.1 mm.

43. An improved time of flight mass spectrometer according to claim 41 wherein the insulator consists of polyamide layer.

44. An improved time of flight mass spectrometer according to claim 42 wherein the insulator consists of polyamide layer.

45. An improved time of flight mass spectrometer according to claim 41 wherein the bipolar deflection plates are curved.

46. An improved time of flight mass spectrometer according to claim 42 wherein the bipolar deflection plates are curved.

47. An improved time of flight mass spectrometer according to claim 43 wherein the bipolar deflection plates are curved.

48. An improved time of flight mass spectrometer according to claim 44 wherein the bipolar deflection plates are curved.

49. An improved time of flight mass spectrometer according to claim 41 wherein the bipolar deflection plates are placed adjacent and parallel to one another such that each metal plate of every bipolar deflection plate is facing the metal plate of the adjacent bipolar deflection plate which has the opposite polarity.

50. An improved time of flight mass spectrometer according to claim 49 wherein the distance between adjacent bipolar deflection plates is a constant.

51. An improved time of flight mass spectrometer according to claim 50 wherein the bipolar defection plates are curved.

52. A multideflector according to claim 49 wherein the distance between adjacent bipolar deflection plates varies as a function of position within the multideflector.

53. A multideflector according to claim 52 wherein the bipolar deflection plates are curved.

54. A multideflector according to claim 52 wherein the potentials on the conducting electrodes is held constant.

55. A multideflector according to claim 52 wherein the potentials on the conducting electrodes is varied as a function of time.

56. A multideflector according to claim 49 wherein the potentials on the conducting electrodes is held constant.

57. A multideflector according to claim 49 wherein the potentials on the conducting electrodes is varied as a function of time.